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NON-HUMAN ACTORS IN THEIR "STRONGLY POSSIBLE WORLDS". CONSTRUCTIONS OF ALTERNATIVE UNIVERSES IN BIO ART PROJECTS[1]

Abstract: The article is an introduction that examines certain perspectives of new-materialist research on the ontological status of alternative universes in bio art projects with reference to the narratological concepts of possible worlds and the storyworld. In this context, it introduces the concept of "strongly possible worlds", which is a complementary concept to the Jan Alber's theory of impossible worlds. This methodological proposal is also presented in the article in reference to the latest study by Francesca Ferrando, in which the idea of "posthuman multiverse" was presented. The author also considers the role of non-human actors in the process of constructing such "in the world stories" (Bruno Latour). As non-human actors bacteria and living cells are understood, which have their own intentionality (goal-oriented behavior) and which are responsible for causal changes to the project; moreover, non-human actors are considered to be a force that affects the physical shape of storyworlds—with reference to Timothy Morton's category of hyperobjects.

The article presents two types of experiments involving the process of creation of possible worlds in bio art. The first one is conducted by the artists working with living materials, mostly tissues and cells, as the duo Tissue Culture and Art Project, Alicia King and Guy Ben-Ary and Kirsten Hudson; the other one is so called bacterial art with Sonja Bäumel's "Expanded body", Pinar Yoldas "Speculative biologies" and "Ecosystem of Excess", as well as Anna Dumitriu's artistic vision "The Romantic Disease: An Artistic Investigation of Tuberculosis" and "ArchaeaBot: A Post Climate Change, Post Singularity Life-form" as special case studies.

Keywords: matter, narrativity, strongly possible worlds, storyworld, bio art, non-human actors, intentionality

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Biological art in the perspective of research on discourse and matter: toward the concept of possible universes

In my article I would like to introduce contemporary artistic activities based on biotechnology procedures in reference to the concept of possible worlds. As far as I know, it has never been done before; therefore, it is in fact a process of testing certain risky research ideas. More precisely, I am going to examine whether it is possible to reveal philosophically-driven context of world's possibility (and potentiality), and some narratological perspectives for research on biological art, as well as how we should redefine some categories and approaches to make research on boundary artistic practices such as bio art possible. Biological artistic practices are analyzed from a number of perspectives (including the debate on biomedicalization and biopolitics, the problem of the body and embodiment, complex relationship between human and nonhuman organisms, etc.[2]), where probably one of the most interesting approaches is an analysis of bio-artistic practices in the context of affective theory.[3] In this article I would like to focus on two aspects of biological art, which I refer to as posthumanistic categories: the problem of non-human actors and the question of the status of the storyworld, as well as possible and impossible worlds in reference to the biological art's universes created in laboratories. I consider these issues in separate subsections of the paper, but both issues are closely related. In my research, I would like to combine the perspective of narratological research especially with regard to conceptions of unnatural narrative (ways of receiving narrative elements that are not consistent with usual experiences of reality) conducted by Jean Alber with observations regarding the material aspect of the ontological status of possible worlds and the processes of their ontogenesis.

Biological art may be considered as one of the branches of post-digital art. As defined by Melvin L. Alexenberg, the category of postdigital art implies artistic projects that are created as a result of the interaction between the digital, biological, cultural, and social, between virtuality and reality, embodied media and augmented space, between sensual experiences, community narratives, and network practices.[4] All of the characteristics of post-digital art may also be ascribed to biological art. Although

[2] See for example: R.V. Burii, J. Dumit (eds.), *Biomedicine as Culture: Instrumental Practices, Technoscientific Knowledge, and New Modes of Life*, New York: Routledge, 2007; B. da Costa, P. Kavita (eds.), *Tactical Biopolitics: Art, Activism, and Technoscience*, Cambridge–London: The MIT Press, 2008.

[3] I conduct this analysis elsewhere: E. Twardoch, "Afektywne opowieści ciała. Narracje i potencjał narracyjny sztuki biologicznej", *Tekstualia. Palimpsesty literackie, artystyczne, naukowe. Narratologia transmedialna* 2015, no. 4 (43), pp. 91–112.

[4] L. Alexenberg, *The Future of Art in a Postdigital Age: From Hellenistic to Hebraic Consciousness*, Bristol: Intellect Books, 2011, pp. 33–96.

it is based on matter rightly called wetware[5] by Roy Ascott, that is on an organic, carnal medium, it often co-exists with digital registration. Many of the projects would have been impossible to create without the use of appropriate computer software, and some of them were also based on network practices, such as Salvatore Iaconesi's "La cura"[6] or numerous projects by Rafael Lozano-Hemmer.[7] What is more, the speculative form of some of the projects does not deny their material concretization. For this reason, reflections on the materiality of worlds created in biological art do not exclude research on their discursive and narrative potential. As claims Karen Barad in her concept of agential realism: 'Matter matters', and material event and phenomenon are not separated entities, they are entangled with social, scientific and cultural discourses.[8]

I my analysis I would like to focus on two types of the projects symptomatic of the latest experiments conducted in the field of biological art. One of them is based on the manipulation of microorganisms, and more specifically of candida and bacteria (therefore some of the artists differ at this field so called 'bacterial art' and 'candida art') and the other one is an example of tissue engineering and so-called *in-vitro art*—projects assuming the cultivation of organic matter in laboratories. Both artistic and scientific methods are relatively often employed by biological artists, undertaking the problem of relations between nonhuman entities with unclear ontological status and ways of knowledge and story gathering.[9] Among the first type of projects we can distinguish a lot of works implemented in the last few years, as: "Surface Dynamics of Adhesion" and "The Tangled Field: After McClintock" by Tarsh Bates, projects of Sonja Bäumel ("Expanded self", "Metabodies", "Cartography of the Human Body", "Oversized Petri Dish"), "Visible Human Bodies" (VHB) by Peta Clancy, "Living Drawings" by Hunter Cole, experiments conducted by Dr. Mehmet Berkmen and Artist Maria Peñil Cobo (initiative "Bacterial Art")—to mention only the most significant from the point of my considerations. The most representative example of this "genre" of biological art for my research will be "The Romantic Disease: An Artistic Investigation of Tuberculosis",[10] and "ArchaeaBot…" both conducted by Anna Dumitriu. I will take a closer look at these two projects, but I will also refer to the works of Sonja Bäumel.

"The Romantic Disease…" is part of Dumitriu's greater artistic objective, the next element of which is "Communicating Bacteria"—the title itself is significant, because it can be considered the motto of her activities—an attempt at establishing

5 R. Ascott, *Reframing Consciousness: Art, Mind and Technology*, Exeter–Portland: Intellect Ltd., 2001, p. 188.

6 Project website: http://la-cura.it, accessed 22.05.2019.

7 Artist's website: http://www.lozano-hemmer.com, accessed 22.05.2019.

8 K. Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*, Durham–London: Duke University Press, 2007, pp. 349–350.

9 See: e.g. SciArt Collection: http://www.sciartcenter.org/sciart-artists.html, accessed 22.05.2019.

10 Project website: http://annadumitriu.tumblr.com/RomanticDisease, accessed 22.05.2019.

contact with microorganisms and to show them as a part of a new, complex, posthumanistic semantic.[11] Anna Dumitriu has been working with TB specialists and researchers of the Modernising Medical Microbiology Project, including Dr. John Paul and Professor Derrick Crook. In the project, the artist tells the story (and it is important that she is the storyteller) of the spread of tuberculosis in Europe from the perspective of Mycobacteria tuberculosis (including strains of *Mycobacterium vaccae*, *M. bovis*, and *M. tuberculosis*, sterilized prior to the exhibition) and inanimate objects (furniture, materials, medical equipment), which played the role of silent witnesses to human fight against the disease. As the description of the project on the artist's website tells us, "[t]he exhibition takes the form of an art/science investigation into mankind's strange relationship with 'the Romantic Disease' Tuberculosis (TB) from early superstitions about the disease, through the development of antibiotics, to the latest research into whole genome sequencing of bacteria".[12]

The author's second project, which seems interesting in analyzed context, is her latest work "ArchaeaBot: A Post Climate Change, Post Singularity Life-form", created with Alex May and shown among others at Festival Ars Electronica 2018, and Biennale WRO 2019. This project fits perfectly with trends visible from the very beginning in the field of biological art, often emphasized by theoreticians: crossing the boundary of the essential human subject, creating hybrid beings, and interspecies relationships, presenting entanglement of agency between various life forms and objects.[13] However, he also takes up a problem that in my opinion determines another face (maybe even another wave?) of bio-art: speculative visions that negotiate the importance of natural evolution and create predictions of life and the world in the era of "postclimate". As claims Ingeborg Reichle:

> However, because we have transformed our entire planet in recent centuries into a kind of laboratory where traditional distinctions between natural and artificial, subject and object, human and non-human agents no longer hold when confronted by the enormous ecological problems and challenges that exist today, speculative biology is now becoming a major issue in Bio Art.[14]

The project is "based on new research on archaea (a group of unicellular micro-organisms believed to be the oldest form of life on earth adapted to life in extreme conditions called (*Sulfolobus acidocaldarius*)"[15] and it is created as a kind of bio-robotic installation, because it is combined with the latest innovations from the

[11] J. Stromberg, *An Artist Dyes Clothes and Quilts with Tuberculosis and Staph Bacteria*, http://www.smithsonianmag.com/arts-culture/artist-dyes-clothes-quilts-tuberculosis-and-staph-bacteria-180949511/?no-ist, accessed 22.05.2019.

[12] *Bioart and Bacteria – the Artwork of Anna Dumitriu*, http://annadumitriu.tumblr.com/RomanticDisease, accessed 24.05.2019.

[13] See: C. Wolfe, *Animal Rites: American Culture, the Discourse of Species and Posthumanist Theory*, Chicago: The University of Chicago Press, 2003.

[14] I. Reichle, "Speculative Biology in the Practices of Bioart", *Artlink* 2014 (September), vol. 34, no. 3, p. 32.

[15] See the Webpage of the artist: https://annadumitriu.tumblr.com/ArchaeaBot, accessed 24.05.2019.

field of artificial intelligence and machine learning. The archaella use cogwheel-like 'motors' to swim and is made through 3D printing—in collaboration with researcher/cryomicroscopist Amanda Wilson.[16] This new kind of being lives in specially prepared, closed in jar, underwater environment, and it refers to the philosophical reflections on *arché*—prasubstance, from which all things were created and at the same time the basic ingredient of reality. Therefore the project creates and presents a perspective of entangled reality of post-singular species and it is really significant reference point for considerations over constructions of possible worlds in bio art.

Another important artist of biological art who creates speculative visions concerning the transformation of living beings and the natural environment is Pinar Yoldas. The young Turkish artist develops a few various manifestations of universes of "speculative biology". From "Speculative Biologies" project from 2008 to the one of the latest and the most significant from the point of possible worlds' artistic manifestation—"An Ecosystem of Excess". "An Ecosystem of Excess" takes into consideration what kind of life and reality forms will evolve from the so called Plastisphere. "Plastisphere" is a term implemented by scientists from Brown University and Woods Hole Oceanographic Institution for the transformation of the marine environments under the of plastic pollution.[17] In reference to these research Yoldas created "the prototypes of neoplasmic organs within organisms, which develop novel survival strategies by adapting to the highly toxic marine environment created by the waste of our affluent mass consumer societies".[18] Specific kind of alternative universe is just the Great Pacific Garbage Patch—a part of the natural environment that was transform into post-evolutional ecosystem, where synthetic molecules impact on natural organisms, creating hybrid space. As the artist claims: "Referring to Kantian aesthetics, it is a truly 'sublime' kinetic sculpture built by all the nations around the Pacific Ocean through many years of mindless, unsustainable consumption. As environmental activist and discoverer of the Trash Vortex Captain Charles Moore boldly claims, the ocean has turned into a plastic soup".[19] Yoldas' project is just the further development of such transformation. It is consist of organs and species of Plastisphere. One of them is Stomaximus is a digestive organ designed to metabolize plastics, and a part of them are little chambers with various chains of bacteria that break down plastic elements. All of these objects of alternative evolution are located in special jars and create speculative, quite coherent ecosystem.

Pinar Yoldas' projects as well as "ArchaeaBot: A Post Climate Change, Post Singularity Life-form" I would like to call "speculative biological art". It is the kind of art & science experiments that not only present to a wider audience current discoveries

[16] See the Webpage of the artist: https://annadumitriu.tumblr.com/ArchaeaBot, accessed 24.05.2019.

[17] See: the Webpage of the artist: https://pinaryoldas.info/Ecosystem-of-Excess-2014, accessed 20.05.2019.

[18] I. Reichle, op. cit., p. 32.

[19] See: the Webpage of the artist: https://pinaryoldas.info/Ecosystem-of-Excess-2014, accessed 20.05.2019.

and innovations in the field of biotechnology and co-create them (what is the major purpose of bio-art—according to many theorists), and not just projects some potential visions, but also they make material reconstructions of the alternative version of the actual reality and make future's direct and physical predictions toward the shape of world. The projects therefore use existing technologies and scientific tools to create artistic vision which sometimes transcend scientific diagnoses and recognitions. As Giovanni Aloi aptly states in reference to the speculative predition: "It always, and insistently, gestures to the outside, to the past, to the present, and it regularly provides a platform upon which the possibility of different futures can emerge".[20]

The second types of works is known especially in implementation created by the Tissue Culture and Art Project—a duo of tissue artists-engineers. Oron Catts and Ionat Zurr's cooperation is part of the activities conducted at SymbioticA—an artistic laboratory at the University of Western Australia. The most well-known project of the duo is entitled *The Process of Giving Birth to Semi-Living Worry Dolls*, and the name basically describes the whole procedure. Inspired by Guatemalan worry dolls given to children to whisper their worries and concerns to, these worry dolls are hand-crafted out of degradable polymers (PGA and P4HB) and surgical sutures. As the authors say, "[t]he dolls are then seeded with living cells: skin cells, muscles cells, neurons (taken in a biopsy procedure) that, throughout the exhibition, will gradually replace the polymers within a micro-gravity bioreactor that acts as a surrogate body. The worry dolls become partially alive".[21] "The Process of Giving Birth to Semi-Living Worry Dolls" is a kind of prototype of such art & science projects, but there are also a lot of latest experiment in the field of tissue engineering, including some solutions from the area of creative design, as: "Afterlife: Immortalization of Kira and Rama" by Svenja Johni Kratz, "Anarchy Cell Line" by Cynthia J Versapaget, works of Hans Arkeveld, "In Potēntia" project by Guy Ben-Ary and Kirsten Hudson, "Cellular performance" created by Verena Friedrich, and so on. I would like to analyze in my considerations "The Process of Giving Birth to Semi-Living Worry Dolls" and the works of Alicia King, especially "The Vision Splendid".

"The Vision Splendid" is an installation consists of bioreactor with the living tissue growing inside. Tissues originate from the skin sample of a 13 year old African-American female and were purchased through the American Type Culture Collection (ATCC) online catalogue—a kind of bio-archive, which itemises over 4,000 human, animal and plant cell lines available for order.[22] As claims the artist, "they are product of contemporary biological technologies acts as the ultimate 'miracle', such as a relic of the dead which is claimed to bleed or weep, as a sign of the direct power

[20] G. Aloi, *Speculative Taxidermy: Natural History, Animal Surfaces, and Art in the Anthropocene*, New York: Columbia University Press, 2018, p. 65.

[21] O. Catts, I. Zurr, "Growing Semi-Living Sculptures: The Tissue Culture & Art Project", *Leonardo* 2002, vol. 35, no. 4, p. 367.

[22] See the Webpage of the artist: https://aliciaking.net/artwork/912636-The-Vision-Splendid.html, accessed 20.05.2019.

of the 'creator', or in this case, institution".[23] There is also the second version of the project with bioreactor with the artist's own skin tissue, taken via shave biopsy, creating "reliquaries, housed in formaldehyde in ritualistic glass vessels".[24]

In medical and biotechnological activities, tissues grown in this way are used mainly to grow artificial organs used in transplantation; therefore, they are to become part of real, living human organisms. Nevertheless, outside of this context, they function as autonomous beings with a complicated status: created from living tissues, which exist outside the body and remain alive only until being put outside the hermetic conditions ensured by bioreactors.[25] Their vitally ephemeral, although strongly material status, of course opens up a field for bioethics, which were repeatedly referred to bio-art.[26] From the new materialist perspective are manifestation of active and generative matter, forms of "materiality that materializes, evincing immanent modes of self-transformation".[27] As "seemingly living", devoid of the purpose for which they are created, the tissues tell stories of life and death (but they are of course introduced by the artist), accentuating the way in which the contemporary world has shifted the boundary between the natural and the artificial and between the living and the dead.[28] However, the artists themselves emphasize that the most important issue that they address in their projects is the relationship between living organism and the body.[29] From the point of my considerations the most important part of the project (as well as in "The Process of Giving Birth to Semi-Living Worry Dolls", "In Potēntia" and other ones) is the glass bioreactor system (I will analyze it in details later) that allows for the viewing of biotechnology processes, living cells, and tissue forms in galleries and other public spaces, shaping also alternative art universes.

The (not only) religious beliefs about relics, the Guatemalan beliefs or the reflection on the post-evolution form of life, as well as and well-known records of tuberculosis or the philosophical thinking on *arché* have been converted into their performative and in the same time carnal and biological versions in the mentioned projects. Therefore, in all cases, certain contexts that are implemented in a filed of art as quite symbolic and abstract cultural and social discourses undergo significant transformations—in relation to the different matter of the artistic work and the new receptive experience that it generates. As emphasizes Aloi, the most important "concerns of new materialism are ontological in nature".[30] Works of art that use organic materials:

23 Ibid.

24 Ibid.

25 O. Catts, I. Zurr, op. cit., p. 367.

26 See among others: R.E. Mitchell, *Bioart and the Vitality of Media (In Vivo)*, Seattle: University of Washington Press, 2010.

27 D. Coole, S. Frost, "Introducing the New Materialism", in: *New Materialism: Ontology, Agency, and Politics*, ed. by D. Coole, S. Frost, Durham: Duke University Press, p. 9.

28 See: project website: https://dublin.sciencegallery.com/visceral/semi-living-worry-dolls/, accessed 25.05.2019.

29 O. Catts, I. Zurr, op. cit., p. 366.

30 G. Aloi, op. cit., p. 30.

constitute a particularly ontologically unstable type of material presence characterized by pronounced specificities that are in turn problematized by the exhibiting space", and therefore "are contextualized as an interface, sensitive substrates upon which human/animal relationships co-shape discourses, practices, and, ultimately, ecosystems.[31]

The projects co-create a kind of entangled realities, both: partly separated spaces with a material basis, which are also an element of complex processual ontologies. By gaining a new form, these require a redefinition of certain categories and an identification of appropriate research perspectives. My reflections on the borderline of narratology and new materialism constitute some of the possible suggestions in this area.

Non-human actors and the issue of intentionality

The ability to create narratives is generally attributed to conscious entities, that is human beings—this is what Monika Fludernik does while writing about consciousness as the medium of narration, emphasizing that it is about anthropocentric consciousness.[32] Here, I do not intend to enumerate the possibilities that exist in the field of post-anthropocentric narratology, even if some reflections on the role of non-anthropocentric entities certainly might constitute a considerable part of such research.[33] Instead, I would like to address the issue of the influence that non-human, animate entities (therefore, not things) have on the creation of narratives. The category of "non-human actors" is associated mainly with actor-network theory and the names of Bruno Latour and Michel Callon, who defined it, in simple terms, as the influence of non-human factors on various social processes.[34] Both researchers emphasize the important relational connections existing between non-human beings and a number of factors as well as animate and inanimate objects. This category is expanded by Levi Bryant as part of the new object-oriented ontology,[35] and—in the context of new aesthetics—also discussed by Ian Bogost[36] and

31 Ibid., p. 31.

32 M. Fludernik, *Toward a Natural Narratology*, London: Routledge, 1996, p. 15.

33 I have not introduced the term "post-anthropocentric narratology" (although it does not appear in any studies conducted in Poland). The possibility of going beyond the anthropocentric framework in studies on narration is proposed also by David Herman, who calls this perspective *narratology beyond the Human*. In his reflections, he is looking for the place for the human "I" in the space inhabited by various forms of life. See: D. Herman, "Narratology beyond the Human", *Diegesis 3. Interdisziplinäres E-Journal für Erzählforschung* 2014, no. 2, https://www.diegesis.uni-wuppertal.de/index.php/diegesis/article/view/165/218, accessed 25.05.2019.

34 B. Latour, *Splatając na nowo to, co społeczne. Wprowadzenie do teorii aktora-sieci*, Kraków: Universitas, 2010.

35 L.R. Bryant, *The Democracy of Objects*, Ann Arbor: Open Humanities Press, 2011.

36 I. Bogost, *Alien Phenomenology, or What It's Like to Be a Thing*, Minneapolis: University of Minnesota Press, 2012.

Adam Dzidowski.[37] Nevertheless, I would like to mention it by referring to Timothy Morton's theory of hyperobjects established on a basis completely different from narratology—the philosophical variant of ecologism and contemporary approach of ecocriticism.

Hyperobjects are characterized by their close adherence to the world of living beings, remaining in a variety of relationships with those; even though they are not local—they live within their own time-spaces—they can be detected there.[38] Therefore, these are certain factors and forces that have global impact and—at the same time—fulfill specific roles in the natural and cultural time-space; they are autonomous beings (although sometimes it is difficult to determine whether animate or inanimate). Hyperobjects are defined by the philosopher by their characteristic features: viscosity, nonlocality, temporal undulation, fazing, interobjectivity. However, they are speculative objects that do not have direct designations. They are extremely difficult to describe through language, but they have enormous power, also in influencing the human world. As Morton writes, they are responsible for the end of the world[39] —the world we used to know. Although in his conception Morton focuses on environmental factors (e.g. magnetic radiation, solar system), I am convinced that this category can successfully include at least some microorganisms determining the existence of nature; for instance, bacteria or reproduced cells—they seem to be entities of indeterminate form, like a force that affects us. In this variant, they are biological in nature, although their importance for the functioning of ecosystems is no less significant than that of environmental factors. What is just as important, hyperobjects exist partly autonomously from our knowledge about them and from the language in which we talk about them; they are independent from us, but still connected with us by means of a network of different relationships, interacting with other entities.[40] In these assumptions arises an attempt at Morton's non-anthropocentric thinking, indicating the limited capacity of human knowledge referring to non-human factors. However, the lack of absolute knowledge causes us to be intimately connected with them, and these connections are based on deterministic dependencies. Hyperobjects are invisible to the naked eye, although the effects of their effects (e.g. radioactive radiation) can be seen. They are also imperceptible, which is why you can easily deny their existence. They function outside human temporal scales,[41] and therefore, among other things, take different forms and relate to various objects.[42]

37 A. Dzidowski, "New and Speculative Organisational Aesthetics", *Organisational Aesthetics* 2015, vol. 4, no. 1, pp. 19–31.

38 T. Morton, *Hyperobjects: Philosophy and Ecology after the End of the World*, Minneapolis–London: University of Minnesota Press, 2013, pp. 1–3.

39 Ibid., p. 2.

40 Ibid., pp. 4–6.

41 Ibid., p. 58.

42 Ibid., p. 70.

Relating these characteristics to the discussed artistic executions, one should say that on the one hand, non-human actors present in them are real objects produced in projects, on the basis of existing materials; on the other hand, they shape the stories told in the projects and—to some extent—also the receptive experiences. Both bacterial strains (as in Dumitriu's and Yoldas' project) as well as cell and tissue colonies (as in the Tissue Culture and Art Project or Alicia King's works) are factors shaping the created universes—"additional" actors, who, together with the artists, but independently from them, influence not only the formula, but also the development of artistic executions. It is them on which the time-space conditions of universes, the way and time of the exposure of the whole, the necessary protection of the recipients, or the ethical dimension of the works depend. In the last part of the article I propose to examine plastic as liminal hyperobject.

In Catts and Zurr's project, the dolls are not only anonymous objects. The authors named them with letters of the alphabet, from A to H, where each of the letters has its own meaning referring to a specific concern or fear. Just as children confide in worry dolls, the authors of the project entrust the most common fears of humankind to tissue dolls. They grow in a so-called "artificial womb", at 37°C, during a period of 14–21 days, and the process of creating them is at the same time a real act of creation and an integral part of the project that contributes to its narrativity. The story created in the project begins not when the dolls are ready, but when the first cells are drawn. The doll named A means "Absolute Truth" that people usually run away from; B is the fear of biotechnology, C—of capitalism, D—of demagoguery and the destruction that follows it, E—the fear of eugenics and the fear that such procedures cause, F—the fear of fear itself, G—the fear of genome manipulations, and finally, H expresses the paradoxical fear of ill-founded hope.[43] Each of the dolls, of course, by means of the artistic conception, carries a field for creating narratives, not only individual, but also social ones. Although these meanings have been ascribed to them, it does not change the fact that tissue engineering, the product of which the worry dolls are, is usually a reason for these particular concerns in society.

The fact that they are composed of organic materials, living ones, determines the nature of all the 'tissues-cells-projects' that I mentioned—they are processual, with its own internal dynamics, creating an intimate relationship with non-human entities, within which we find ourselves every day as well. The process that forms the matter of the project is the sequential development of tissues as organic beings—from their harvesting until death; therefore, the artists have planned it in a way in which narratives about a specific character or characters are created, presenting their fates from birth until the end of their lives. However, the intentionality of the artists as authors is ambiguous and non-exclusive—it is caused by the particular matter of the project, the medium used, which is a biological organism. Regardless of how exactly the artists plan the shape and course of their projects, these are just as dependent on natural,

[43] O. Catts, I. Zurr, op. cit., p. 368.

biological changes of the organisms present in them. Cells are characterized by their own development cycles and specific impact on other beings and on the space in which they exist; therefore, they are a force that undergoes internal changes, always resulting from a biological purpose. Accordingly, these are not accidental transformations or ones generated only by the author of the project; they are supposed to lead to a specific purpose—to an event, such as cell division or growth, one of which is also death—the end of the story. In the projects, intentionality has thus been divided between its authors and actors, who are at the same time its protagonists and the matter of artistic projects. This is one of the phenomena in which both the media specificity of this biological art project and its peculiar narrativity are revealed.

In the project "The Romantic Disease: An Artistic Investigation of Tuberculosis", the main character is the bacterium causing tuberculosis—it determines the story, the objects that form it, and the world created. In this context, very interesting elements of the project are various textiles that Dumitriu has prepared in this way—by using chromogenic nutrients that make the material change its color under the influence of bacteria. This procedure causes the fabrics to be covered in patterns and stains.[44] The activity and transformation of the bacterium have thus gained a special form of representation—synonymous with the procedure, having visual effects, available to the audience, reflecting the process of purposeful change occurring inside microorganisms and between them and other actors. Therefore, the artist ensures that the story of tuberculosis, in which Dumitriu shifts the focus from a socio-cultural construct to the biological development of bacteria, has representational traces of its transformation and creates a narrative—even if the starting point of this narrativity constitute invariably intentional affective transformations of microorganisms.

In this way, Dumitriu's method makes the relationship with microorganisms, just as with hyperobjects in general, remain invisible, gain its visual face that can be read as signs, as I have said earlier, or also as an amorphous effect of the affective contact between human and non-human actors, which takes a more or less accidental form by means of the activity of chemical preparations. The influence and tension between the agents, within which the source of the project's narrativity is found, have no unambiguous form. At the same time, this is communication through signs, as well as influence on the material, physiological level of human and non-human actors—an experience based on a series of events and changes.

By developing this concept, Dumitriu is currently in the process of completing another project, "Communicating Bacteria", recognizing that such activities of microorganisms might be their way of communicating with human beings.[45] The fact that Dumitriu ascribes the communicative value to her project and communicative abilities to microorganisms only confirms the peculiar internal purposefulness of their

[44] See: J. Stromberg, op. cit.

[45] E. Kekou, "Interview with Anna Dumitriu", *4Humanities International Correspondent* 2013, January 18, http://4humanities.org/2013/01/dumitriu-interview/, accessed 26.05.2019.

transformations and provokes us even more to discern different, corporeally-driven narrative dimensions in them. As rightly noted by Rembowska-Płuciennik, narration functions as a message.[46] The act of communication creates a field, an incentive for the existence of narration, although it may, of course, take a different form, such as that of argumentation. In case of this project, this particular attempt at establishing contact, expressed through stains and patterns, operates in parallel as a witness to change—an essential element of narration. This change occurs as a result of contact between microorganisms, with their internal purposefulness of transformations, with the environment, the artist, the audience—it constitutes the effect of tension between factors creating the story told in the project. This communication is based on certain incentives and their consequences, actions and reactions, on transformational processes. It is difficult to see argumentation or description in them—they are events caused by different actors, with their real reflections in the project. Therefore, Dumitriu's work causes the invisible relationship with microorganisms, as with hyperobjects in general, gain its visual aspect that can be read as signs—as I have said before—or also as an amorphous effect of the affective contact between human and non-human actors, to which more or less accidental forms are given by biochemical preparations. The mutual relationships and tension between the agents, in which the source of the project's narrativity is found, do not have a clear form. Simultaneously, this is communication through signs as well as interaction on the physiological level of human and non-human actors—an experience based on a series of feelings and transformations.

Bacteria are of global importance, having implications as strong as the biosphere or the impact of the solar system mentioned by Morton; above all, they determine the artistic universe created by Dumitriu in a comprehensive manner, modify the properties of objects, provide an incentive to tell the story, elicit affective reactions, and influence the processual character of the execution. Within the projects, it is by them that Morton's concept of the "era of asymmetry" is implemented, contained between the "infinite force of cognition and the infinite existence of things".[47] What is more, to some extent, bacteria are speculative objects: invisible to the naked eye, they are very often the heroes of media reports of various diseases caused by drug-resistant bacteria. Therefore, on the one hand, it is human beings that narrativize the world by means of cognitive functions, giving it a readable form; however, there are also an infinite number of objects functioning independently from consciousness, which influence the process of creating a performative, material narration or even determine it. Often, before we rationalize those, they are recognized by our bodies, in their affective dimensions. They are a kind of non-human agencies that by means of their developmental and metabolic processes influence the environment around

[46] M. Rembowska-Płuciennik, *Poetyka intersubiektywności. Kognitywistyczna teoria narracji a proza XX wieku*, Toruń: Wydawnictwo Uniwersytetu Adama Mickiewicza, 2012, pp. 98–102.

[47] T. Morton, op. cit., p. 22.

them. The authors of the presented projects are not able to exercise absolute control over the organic matter in which they work. The narrativity of this project, that is intentional changes occurring at a specific time, forming particular events composing the whole process,[48] depends on the course of the natural development of non-human actors. It means that the "emerging" is determined not only by the rational concept of the whole, but—above all—by automatic metabolic processes occurring in organic matter. Moreover, to a certain degree, it is almost identical with them: the dynamics of the project arises directly from the behavior of goal-oriented living organisms[49]—and this goal is to achieve the next level of metabolic development, e.g. that of bacteria. What is more, even the temporality of exposure is determined by minutes, hours, and days, necessary for a given biological process to take place. Substantial to literature and any other types or narration, in biological projects the category of time does not arise from semiotic limitations but from these generated by organic matter; it is also inextricably connected with volatility and motion, according to Brian Massumi being the foundations of affective processes and reactions.[50] In this case, it is affective transformations occurring in the bodies of non-human actors that influence the time frames of the project, indicating the instability of narratological categories structuring verbal messages. Therefore, it is very difficult to say who is the right narrator of the project. Here, narrative gains a slightly different status: a performative event in which agency is relational. It should not be forgotten, however, that the Dumitriu project, like the other works mentioned by me, are not devoid of anthropocentric gesture. Communication situations are created here by a human—an artist, and scientific laboratories—as Latour shows—by definition are places where hegemony reigns over the natural world.[51]

One must admit that it is difficult to speak of traditionally defined intentionality (although, for simplification purposes, so far I have actually been writing about intentionality), which assumes conscious and rational conceptuality. It is also difficult to deny that we do not deal only with the authors' intentionality in both projects. In view of the above, it would be best to define this narrative agency of non-human actors as goal-oriented behavior. This category encompasses the described intentional dynamics of cell and microorganism transformations influencing subsequent events and changes occurring within the projects. Following the anthropocentric perspective, it

[48] Here, I refer to the general definition of narration proposed in the book edited by Todd Wilkens: *The Role of Narrative in Understanding Digital Video: An Exploratory Analysis*, ed. by T. Wilkens, p. 2, https://open-video.org/papers/Wilkens_Asist_2003.pdf, accessed 26.05.2019.

[49] About this type of behaviors among mobile animal groups one may read here: C.C. Ioannou, M. Singh, I.D. Couzin, "Potential Leaders Trade Off Goal-Oriented and Social Behavior in Mobile Animal Groups", *The American Naturalist* 2015, no. 186 (2), pp. 284–293.

[50] B. Massumi, *Parables for the Virtual: Movement, Affect, Sensation*, Durham: Duke University Press, 2002, pp. 1–2.

[51] B. Latour, *Pandora's Hope: Essays on the Reality of Science Studies*, Cambridge–London: Harvard University Press, 1999, pp. 30–32.

is difficult to admit that the behaviors are intentional; nevertheless, it does not change the fact that—as I have mentioned—these arise from efforts to achieve a certain metabolic purpose. On the other hand, these deliberate activities are at the same time a certain, natural, assumed in the project series of transformations, in which non-human actors are to surrender as characters belonging to the project. Therefore, not only do their goal-oriented behaviors determine the shape of the project and complete the author's intentional activities, but they also remain synonymous with the characters' fate: the road of changes that they have to travel in a given story.

It is also worth considering non-human actors as the main characters and inhabitants of alternative worlds created by the artists. They have created universes in which these (hyper)objects, existing as part of and influencing the affective sphere of our physicality, nuance the narrative potential of these worlds. On the other hand, these universes—the way in which they are created and shaped—determine the narrativity of the projects alongside the agential activities of non-human actors.

"Strongly possible worlds" and the question of the material dimension of the storyworld

A storyworld—I am citing the meaning of this term as defined by Marie-Laure Ryan—is a world adapted to create or have appropriate conditions for a story to occur and exist in it. It is also a dynamic model of changing events and situations, with a representation in the recipient's mind—therefore, it is not identical with the represented world. It has its own parameters: characters, setting, laws of physics, socio-moral principles, events, and mental events.[52] This kind of storyworld which is constructed in biological art has it laws of physics, biologically formed characters, principles of functioning based on the matter of execution, and—due to cognitive operations—depending on the competences, one may determine the socio-moral principles applicable in it. In the bio-art project (as "The Process of Giving Birth to Semi-Living Worry Dolls", "In Potēntia" or "Vision Splendid"), the world in which it is possible for the story to take place is a hermetically closed space of a laboratory's incubators or bioreactors, designed so that living tissues or bacteria can develop, multiply, and transform in it, then formed to be autonomous creatures—the protagonists of the story. This is a space with peculiar physical conditions, subject to the course of time, adapted to the characters of the story, determined by an already existing, known context—the Guatemalan tradition of "worry dolls", or the hybrid materiality of the human body, customized by other actors. In "The Romantic Disease: An Artistic Investigation of Tuberculosis", the world presented in the installation has been created so that a story about *mycobacterium tuberculosis* could originate

[52] M.-L. Ryan, "Story/Worlds/Media: Tuning the Instruments of a Media-Conscious Narratology", in: *Storyworlds across Media: Toward a Media-Conscious Narratology*, ed. by M.-L. Ryan, J.-N. Thon, Lincoln–London: University of Nebraska Press, 2014, pp. 33–37.

and develop; however, this world is different from the one in which the story used to exist, as there is a different protagonist, and the conditions of its exposure are different as well. The elements composing this universe have been specifically prepared, and their structure—transformed by means of the implantation of biological material. These are affected by time: they slowly change their appearance and properties, can be rearranged and complemented. Pinar Yoldas in her project "An Ecosystem of Excess" created the different form of physical sphere—Plastisphere, something even more than a single universe presented. Plastisphere defines the biophysical conditions for the existence of marine environments under the plastic pollution in general. It is a comprehensive story about the post-evolutional ecosystem, with its own protagonists, settings and climate under the ongoing process of transformation.

Undoubtedly, it is quite difficult to equate such space with the traditional represented world, although it is enough to accept that a different medium of the creation of the project generates different principles of the creation of the storyworld in which it takes place. To the emergence of such worlds complicated biotechnological processes and procedures rather than the writer's or painter's hand lead, which does not deprive the projects of their narrative potential. However, narrativity generated in the context of this kind of storyworld is not determined by construction principles and the elements described, but designed to initiate narration by means of intense incentives stimulating the cognitive apparatus, such as confrontation with the physical corporeality "put" before us, with shapes upon contact with which we feel uncomfortable, or through simulation of temporality, not in terms of verbal determinants of sequentiality, but through changes in states depending on the principles of the world created and on our own experiences. In a storyworld built in this way, based on affective stimulation, certain determinants assigned to this category are thus redefined or negotiated, not because their separation is unauthorized, but due to their material concretization.

In all projects cases this is the world in which one does not speculate on the basis of textual determinants, but which has precise, physical rules (temperature, air composition, pressure), and which—on this basis—can be possibly rebuilt with further details. In spite of its physical reality, it is also a universe partially different from the real one. The status of this world is emphasized by the boundaries of the room, the boundaries of the sealed cylinder, in which different physical conditions are found. The death of the dolls from the mentioned project is the result of a confrontation with the conditions of another world—one with a different ontological status. One of them is real; the other one balances on the edge of reality and fiction. However, each of them is characterized by their specific physical conditions. On the other hand, the death of the dolls—as a potential finale of the story—results in further narrative tension resulting from the alignment of these two different universes. This is yet another element and part of the story that cannot be achieved in this form by means of another medium.

Therefore, the designs of universes by all the mentioned artists go beyond the matter of text, at the same time creating a special kind of storyworld, executing the idea of possible worlds, directly implanted in the field of narratological studies (its usefulness was earlier noted by Umberto Eco, Thomas Pavel, and Lubomír Doležel[53]) by Marie-Laure Ryan in her 1991 book.[54] The distinction between both categories—the storyworld and possible worlds—is, with reference to the analyzed projects, especially significant, as on the one hand, it highlights the potential narrativity of the biological universes, what it is not so obvious, and, on the other hand, reveals their ontological completeness in philosophical sense, which seems to additionally strengthen and update the performative potential of these worlds. Here one should note that relating the theory of possible worlds to studies on narrativity was criticized by philosophers (Ruth Ronen) because of the incompatibility of literary universes with this ontological concept.[55] Therefore, going beyond the identification of narration with the matter of language (but it does not mean that also with discourse) may bring a more interesting application of the theory of possible worlds into considerations on biological art.

Possible worlds, according to their philosophical definition, which is inspired by the theory of monadology conducted by Gottfried Leibniz, but not entirely consistent,[56] are generally defined in relation to the actual world. The actual world is one of many possible worlds being the version of reality that is current to me. Depending on interpretation, it is the one in which I, as its resident, am placed, so it is actual among other possible worlds only because it is my world and other ones are unactualized possibilities (David K. Lewis' modal realism[57]) and one that can be connected by means of different relationships with other possible worlds or exist autonomously from them, thus existing as an independent being (Nicholas Rescher[58]). As Ryan notes, with respect to literature, the issue of the veracity of certain statements and laws of logic remaining in relation to fictional storyworlds has become crucial.[59] The consequence of these considerations is a statement—proposed by Ryan—that when the reader reconstructs a fictional world, he or she completes gaps in its design, assuming its similarity to the reality that he or she is experiencing. In other words, during this process, a possible world becomes the actual world to the reader, currently consistent and coherent in relation to reality (possible in relation to reality), although

53 M.-L. Ryan, "Possible-Worlds Theory", in: *Routledge Encyclopedia of Narrative Theory*, ed. by D. Herman, M. Jahn, M.-L. Ryan, London 2005, p. 446.

54 M.L. Ryan, *Possible Worlds, Artificial Intelligence, and Narrative Theory*, Bloomington: Indiana University Press, 1992.

55 Ibid., p. 446.

56 It is worth to mention at least three main prominent philosophical approaches to the nature of possible worlds: concretism, abstractionism and combinatorialism, see: *Possible Worlds in Stanford Encyclopedia of Philosophy*, https://plato.stanford.edu/entries/possible-worlds, accessed 24.05.2019.

57 D.K. Lewis, *On the Plurality of Worlds*, Oxford: Blackwell, 1986.

58 N. Reschner, *G.W. Leibniz's Monadology*, Pittsburgh: University of Pittsburgh, 1991.

59 M.-L. Ryan, *Possible-Worlds Theory…*, p. 448.

at the same time not reduced to it (remaining separate).[60] This possible world becomes a complete modal system and a comprehensive ontological being, at least with regard to the experience of the recipient—in this case, the reader, but of course we can also talk about a film viewer or a game player, but here the issue is more complex due to the direct interaction with the observed universe.[61] To some extent, the specificity of a fictional world makes it go beyond its own textuality due to its basis in a real universe, still being a world created by a novel or another medium.[62] The criteria determining the status of possible worlds are their *possibility* and *accessibility* in relation to the real world, and these depend not only on the laws of logic, but also on those of physics and on material causality.[63] These criteria allow us to determine whether a world constructed in this or another way could exist in reality; therefore, whether it is a world possible to reality.[64] One of possible-world theorists, Thomas Pavel, notes also—which is one of the most important issues in the theory of possible worlds—that fictional, textual categories, characters, and ontologies do not have their denotations in the real world and thus the status of literary fictions as possible worlds is questionable.[65] I would like to show that in the context of the field of biological art the question is more complex, but less questionable.

The most important perspective for my research is concretism's version of possible world theory, that is also partially applied to narratological considerations. One of the implementation of this perspective is modal realism introduced by mentioned above David K. Lewis. Lewis claims that there is a plurality of worlds, and our world is "but one among many".[66] All possible worlds are very inclusive and spatiotemporally isolated from every other world. They do differ in things that are parts of different worlds, but don't differ in a kind and in its manner of existing from the actual world, therefore "absolutely every way of that a part of a world could possibly be a way that some part of some world is".[67] But there is no causal relations between worlds: "objects in distinct worlds bear no causal relations to one another; nothing that occurs in one world has any causal impact on anything that occurs in any other world",[68] what is really problematic and questionable statement in reference to bio-art universes. The possible worlds are as real as our world, they have their own

60 Ibid., p. 447.

61 Ibid.

62 Ibid.

63 Ibid., pp. 448–449.

64 Therefore, Howell, among others, believes and proves in his article that worlds in literary fictions, full of logical and physical contradictions, could not exist as worlds possible in relation to reality; see: R. Howell, "Fictional Objects: How They Are and How They Aren't", *Poetics* 1979, no. 8.

65 See: A. Łebkowska, "Fictional Worlds", Thomas G. Pavel, Cambridge, MA and London 1986 [review], *Pamiętnik Literacki* 1989, no. 3 (80), p. 393.

66 D.K. Lewis, op. cit., p. 2. Therefore the concept of Lewis is also very closed to the 'multiverses theory', conducted also in the field of cosmology.

67 D.L. Lewis, op. cit., p. 2.

68 Ibid., p. 3.

rights, causality and logics. Due to this fact they are not reducible in themselves, but a linguistic modality (so the modality of the truth of sentence, possibility and impossibility and logical necessity) which is a base for this theory, is not irreducible, and it can be reduced to the perspective of the real possible world[69] (what, as I have shown above, it is core aspect of theory of possible world for the literary and narratological research). I will show later that in reference to the bio-art universes much more interesting conclusions can be brought by replacing the linguistic modality with modality of ontological findings—'naturalness' and 'artificiality' of entities, as well as modularity within the potentiality of possible worlds—from abstract speculation to material actuality.

This specification introduced by Lewis has been slightly modified by Yuk Hui, who agrees with Lewis that there is no just one world, but many of them, but he also claims that:

> These worlds are not isolated like the monads that contain other worlds internally and implicitly but are rather open to one other and unified in digital objects through interobjective relations. The digital object opens up worlds, unifies them, and discloses to the users of the other possible worlds that objects are not passive syntheses but refer you to somewhere else, out of anticipation; this is usually called serendipity.[70]

The context for introducing the theory of possible world is for Hui "relational realism", so not the modality of universes properties are in the core of this concept, but the relationships between them and between various entities, also non-human. At this point, Hui's considerations remain in line with Morton's concept. According to Hui such time-spaces have their own properties and parameters, but they aren't isolated (this is the most often criticized part of the Lewis's theory). The theorist presents his concept in reference to the ontological status of digital objects, but I am convinced, that we can also refer this statement to the context of the existing of biological art's universes, that are shaped in organic matter (it is a difference only between kind of matter, because for Hui digital objects are not immaterial). It is due to the fact, that they are quite available and open to interventions from the artist (and sometimes also from the public) and observations to the viewers, what usually brings a lot of consequences for existing of the exposed world. It is worth emphasizing that they are also "open" in a different sense. Biological art creative laboratories are a part of science infrastructure (or in Karen Barad's words—apparatus): regime of protocols, methods, as well as the system of administration—patents, permissions and capitalist exploitations of biotechnology's, commercial potential. They are not magically separated from the postmodern world of art and science. They are ephemeral and fragile projects not only in reference to the materials used, but also their places in the technoscience regime.

[69] Ibid., p. 5–6.

[70] Y. Hui, *On the Existence of Digital Objects*, Minneapolis: University of Minnesota Press, 2016, p. 219.

What is more, such bio-universes are quite unified in kind (in both cases they are made of bacterial organism or tissues and cells and have similar physical parameters), and also they are created in purpose to somehow show the communication dimension with the artist or the observer—that is mostly seen in case of Anna Dumitriu's work. As claims Hui:

> The formation of interobjectivity, conversely, conditions the "We", which is itself not possible without experience, that is, without experiencing each other. If our hypothesis is reasonable, the way we interact with objects and enter into communication with them constitutes the "we" in the digital milieu. There is a passing over from the meaning of the cognitive to the meaning of the "we".[71]

The universes of biological art are partially internal for themselves and closed under some necessary physical circumstances, so they generally differ from digital entities, but as shows Hui digital object are also a part of specific technical system (and our relationship among it) and are subject to its conditions. The biological universes are also created through some interobjective relations under a certain system—in biological art it is biotechnological system of specific procedures and practices. Moreover, it is worth to claim that—as shows Hui—possible worlds are not only an element of the cognitive act, but they retain their material and empirical status. Which, on the other hand, does not mean that they are not time-space object to any cognitive processes.

The important polemic about Lewis theory introduces also Francesca Ferrando in her concept of "posthuman multiverse". The concepts of possible worlds and multiverse are not synonymous (but, they remain close), and Ferrando's book lacks this indication. However, this does not change the fact that the proposal to adopt a posthumanist perspective can, I think, be applied to the both concept. Ferrando notes an important point for research into posthuman reality: so far, philosophical findings have defined possible worlds as isolated, essentialist human spaces. Even in cosmological research, in which we should definitely talk about the non-human world, research on alternative spaces is always conducted in relation to the values and needs of human beings and these are worlds which human can postulate.[72] Therefore, she introduces a kind of recontextualization of Lewis' definition, claiming that: "the posthuman understanding of the multiverse would be envisioned as generative nets of material possibilities simultaneously happening and coexisting, corresponding to specific vibrations of the strings, in a material understanding of the dissolution of the strict dualism one/many".[73] Posthumanistic multiverse is both relational and autonomous, it is based on "symbiotic energetic alliances", connection, intra-activity with different form of being and related with other spheres by vibrational structure, "in

[71] Y. Hui, op. cit., p. 219.
[72] F. Ferrando, *Philosophical Posthumanism*, London: Bloomsbury Publishing, 2019, p. 176.
[73] Ibid., p. 178.

a radical onto-existential re-signification of being".[74] Multiverses are not isolated, but relational, performative, embodied, physically connected.

Creative bio-art laboratories are to some extent an attempt to implement the idea of "posthuman multiverse". They form partially separated, autonomous spaces, but their main goal is to show the connection (also communication), relationality between human and nonhuman beings—like bacteria inhabiting the human body. In my opinion, the concept of strongly possible worlds can be a development or complement to Ferrando's proposal, emphasizing the material dimension of space-time in artistic projects and the problem of speculative ontologies.

This short recognition among the concept of possible worlds allows us to notice that in projects of bacterial art and tissues-cells art we encounter a special kind of creation of the universe. In the all analyzed cases, these are neither textual nor clearly fictitious worlds; rather, they are alternative speculations about reality—congruent with the real world because they constitute its variation (the world of quasi-living dolls, the world of or the world whose protagonist is *mycobacterium tuberculosis*), and the possibility of their existence is simultaneously confirmed by the fact of their execution, supported by scientific experiments, calculations, and procedures. Both have their own parameters and laws of physics, which are not mere theoretical determinants, but which directly determine the created world and the creatures that inhabit it. They have been imagined and made by artists, but the ideas have also been verified by biotechnological procedures on an ongoing basis in order to introduce optimum data. The worlds go from the sphere of possibility to actuality on the level of original constructs, as this plan must be regularly verified. In this respect, the "material causality" described by Ryan is executed, determining the multitude of interpretative dimensions of the projects. On the one hand, this is an autonomous world that exists materially and physically, regardless of interpretation—one that, having narrative potential, is updated in various forms through the recipients' different interpretations—forms variational in relation to its basic version.

The universes created in the discussed projects go beyond the definitional boundaries of storyworlds and possible worlds; therefore, in my article I suggest labeling them as a new category of "strongly possible worlds" referring both to the discussed theory of possible worlds as well as to the contrasting concept of impossible worlds developed by Jan Alber in the context of reflections on unnatural narratives.[75] The German theorist refers to literary narratives, and thus a confrontation between this concept and non-verbal reports appears interesting. The category of the "unnatural" is understand in this theory in cognitivist perspective: means everything what goes beyond the laws of logic, the laws of nature, and human knowledge and cognitive (not perceptual) skills—elements that allow the creation of coherent cognitive

[74] Ibid., pp. 178–181.

[75] J. Alber, *Unnatural Narratives: Impossible Worlds in Fiction and Drama*, Lincoln–London: University of Nebraska Press, 2016.

frames for the purpose of constructing narratives,[76] at the same time setting their boundaries.[77] In Alber's theory, the impossibility that arises from the unnatural defined in this way concerns thus the narrator, the characters, and the time and space[78]—the basic elements of narratives. It is not synonymous with "fantasy" or strangeness (in fantasy or science-fiction what is unnatural usually has logical and physical reasons behind it); on the other hand, it means going beyond the physical and logical frameworks of the real world.[79] To the theorist, this impossibility does not cause "cognitive paralysis"—the disappearance of human interpretative skills[80]—what is more, it is an integral part of literary narratives.[81] On the other hand, it requires each time the development of new cognitive frameworks that allow for its interpretation because—as I have mentioned—it usually clashes with the known laws of nature, physics, or logic of the real world.[82]

It seems, that the proposed category of "strongly possible worlds" would be found exactly on the other pole, opposite the one on which Alber puts "impossibility"; but paradoxically, it does not mean that these categories do not have any converging points. In fact, it is the concept which combines theory of possible worlds and categorization of impossibility. Alber focuses mainly on the logical impossibility of fictional worlds,[83] but notes also—referring to Doležel's theses—that this impossibility may also be physical, so results from paradoxicity and lack of coherence of a world's physical parameters.[84] I my concept, "strongly possible worlds" are possible in both aspects—the logical and physical one, but it not so unequivocal, because it does not mean that their parameters are identical with these of the outside real world. The biophysical parameters of the external space (like air pressure, thermal data, exposure) are most often used in them, but in configurations that are different from those prevailing in the real world. A good example here are bioreactors that create a kind of alternative but materialized environments, and that are alternatives to laboratory incubators. In the project "The Vision Splendid" created by Alicia King the bioreactor is a universe that simulates artificial body: its sterile, lo-fi, and inside the temperature is maintained at 37 degrees (natural temperature of human body). As a form of glass chamber, it is closed to the real world. Another example could be specially prepared glass vessels customized by eight kind of microorganism in the

76 Ibid., p. 3.

77 L. Zunshine, *Strange Concepts and the Stories They Make Possible*, Baltimore: Johns Hopkins University Press, 2008, p. 19.

78 J. Alber, op. cit., p. 3.

79 Ibid., p. 14.

80 Ibid., p. 9.

81 Ibid., p. 12.

82 J. Alber, op. cit., p. 25.

83 Here, I refer to the following assumption: "By contrast I argue that a narrative can contain logical impossibilities—if (and only if) a storyworld is represented in which two logically incompatible statements are true at the same time"; see: J. Alber, op. cit., p. 30.

84 Ibid., pp. 25–26.

project of Tarsh Bates, titled "Self portrait with candida"[85] or the "sculptural incubator reminiscent of 18th century scientific paraphernalia" created by Guy Ben-Ary and Kirsten Hudson, in the project "In Potēntia".[86] The same applies to projects in which specially transformed petri dishes are used. Petri dish is a glass or plastic container, consists of two element: the bottom and top ones. They are generally sterile, filled with liquid containing agar and a mixture of specific ingredients (as salts, blood or dyes). In her unusual project "Expanded self", Sonja Bäumel created a huge petri dish (210 cm × 80 cm) that contains the bacteria living on her own body. Filled with agar, the petri dish became a living landscape which was growing there a few days.[87] Due to the naturally occurring metabolic processes inside the container, the petri dish has become a hermetic, hybrid environment, linked to reality but also separated from it. Such closed universes correspond with reality are something else than for example the projects of Vaughn Bell ("Metropolis", "One Big House", "Village Green"), which are glass or plastic container filled with various kind of flora.[88] In these projects containers are open from the bottom, so the viewers can interact with the them, and there is constant air circulation between the space inside the container and the outside. Therefore, they are not alternative possible worlds, but only parts of the real (primary) space delimited.

It is worth to add, that Alber links his considerations to the category of the unnatural, himself noting that often what is natural or unnatural is connected and thus it is difficult to determine clear unnatural narration.[89] In a similar way, it would be incorrect to connect the "strongly possible" category only with what is situated within the scope of naturality—what is particularly evident in the partially artificial construction of universes of biological art. Moreover, Alber's study "[…] comprises two types of impossibilities. First, it denotes impossible elements that have *not yet been conventionalized*, that is, turned into basic cognitive categories, and therefore still strike us as odd and disconcerting. Second, it also refers to impossibilities that *have already been conventionalized* and have thus become familiar conventions for narrative representation".[90] Analogically, the "strongly possible" category operates, which does not imply the supernatural, but what is independent of whether it is conventionally believed to be natural or not and what constitutes an element of the actual, possible world. Therefore, whether we think of an impossible world or a "strongly possible" one, we must take into consideration the fact that both can contain unnatural elements to the same extent—also in terms of narration. Moreover, the parameters of both

85 See here: http://www.symbiotica.uwa.edu.au/research/postgraduate/tarsh-bates, accessed 26.05.2019.

86 See the Webpage of the artist: http://guybenary.com/work/in-potentia/, accessed 26.05.2019.

87 See the Webpage of the artist: http://www.sonjabaeumel.at/work/bacteria/expanded-self, accessed 26.05.2019.

88 See the Webpage of the artist: https://www.vaughnbell.net/one-big-house.html, accessed 26.05.2019.

89 J. Alber, op. cit., pp. 28–29.

90 Ibid., p. 42.

require an activity that Alber calls "restoring the cognitive balance",[91] that is the cognitive assimilation of unnatural elements, especially time- and space-related, of given universes. A similar issue is addressed by Zunshine, who claims that impossibilities are crucial for cognitive development.[92] I believe that our cognitive apparatus is affected in a similar way by "strongly possible" elements—as opposed to impossible ones[93]—fully planned, with predictable consequences, often incompatible with the reality that we know, thus requiring assimilation.

Alber notes also that "[o]ne of the most interesting things about fictional narratives is that they not only reproduce the empirical world around us; they also often contain nonactualizable elements that would simply be impossible in the real world".[94] In case of "strongly possible worlds", the situation is even more complicated than the one referring to literary fictional universes: on the one hand, not only do they reproduce the physical world—on the other hand, they bring to real existence (therefore, these are always actual) spaces that could appear impossible and unnatural with reference to reality (such as the environments of "tissue dolls" or speculative world of "ArchaeaBot"); yet they are created in a material way, in the real world. They are not mimetic (which does not make them antimimetic—as in the case of impossible worlds, according to Alber[95]), but they also withstand philosophical objections concerning the possibility of updating fictional worlds.[96] While, as stated by Ruth Ronen,[97] fiction may construct impossible objects that are not reflected in the real world, in "strongly possible worlds", every impossible element becomes physically, materially possible once it is created (or grown), even if it is generally speculative, so in common understanding—fictional. It is updated at the moment of occurring in real time-space. Therefore it is still crucial, whether a world constructed in this or another way could exist in reality—in reference to the mentioned theories of possible world, but the main criterion is not the linguistic or logical modality. Something false (even logically false, as: a dog has six legs), speculative or impossible could be a part of possible and actual world, because and if it is created materially and exists in ontologically consistent universe. Among such the universe some entities and other element can be perceived as natural or unnatural, but these categories gain different meaning than in narratology. Unnatural is not only what constitutes the effect of an abstract experiment of the creator (as in literature or text, e.g. a talking dog), which the recipient regards as incompatible with their own cognitive scripts, but also what has been created artificially, in bio art case—by using laboratory's infrastructure.

91 Ibid., p. 43.
92 L. Zunshine, op. cit., p. 114.
93 See: J. Alber, op. cit., p. 215.
94 Ibid., p. 3.
95 Ibid., pp. 185–187.
96 L. Zunshine, op. cit., p. 69.
97 R. Ronen, *Possible Worlds in Literary Theory*, Cambridge: Cambridge University Press, 1994, p. 45.

Unnatural and logically false is therefore the organo-robotic creature and its environment in "ArchaeaBot", but it is not impossible or ontologically false. The binary division into natural and artificial is rightly criticized (starting with Donna Hcgway), but in my article these categories are needed to indicate the differences in the construction of possible the worlds in strictly discursive and material spaces.

An even more complex situation is in the case of Pinar Yoldas' projects. The created universes are here a kind of speculation—potentiality in the process of material transformation of the world, which at the same time has already been actualized within a specific time and space of the projects. What is more, a foundation for "Ecosystem of Excess" is the real hybrid relationship between the synthetic molecules and natural organisms, but it develops an alternative vision of such connections (intra-actions as shows Barad[98])—a highly toxic sphere of the world where all the organism inhabited it had to develop the strategies of adaptation and survival as the specific kind of neoplasmic organs. It is therefore a vision of Anthropocene, which has already become Entropocene[99]—as Hui called the situation of the disintegration in which the natural world found itself as a result of changes that Yoldas defines as post-evolution. The Yoldas project can thus be described as a speculative vision of the world, which in relation to reality remains in the process of ongoing actualization. It is also example of ontological modality: speculative design is realized as a universe with a material foundation that can become an actual anticipation in relation to the transformation of reality.

The Yoldas' project can also be analyzed as a discussion with Morton's hyperobjects concept. In this context, I propose to see plastic as a hyperobject with a rather special status, which to some extent negotiates the definition proposed by the philosopher. On the one hand, plastic is a well-known material, widely used in everyday activities. On the other hand, the effects of plastic flooding on the planet have been notorious for a relatively short time, with varying social effects. Plastic is becoming one of the most dangerous objects for natural environments, one of the symbols of Capitalocen: macro- and micropolitics of easy profit and exploitation. As the artist shows, plastic begins to bring about real changes in the biosphere, disturbs biodiversity; it creates alternative spheres that most of us will not see (as the very sphere of Pacific Garbage Patch) but which are beginning to have the status of media legends. Plastic is vicious, covers ever larger areas of nature-culture. What's more, it is also material to which people are stuck—Morton rightly points to this ambiguity. It is characterized by nonlocality (this phenomenon is as global as it is probably no other today), temporal undulation and fazing (the way it is produced and used changes, it affects organic matter, creating hybrid, post-evolutionary objects and entities, etc.).[100] What is more, as Yoldas shows, plastic has ceased to operate within our time and

98 K. Barad, op. cit., pp. 202–221.

99 Y. Hui, *On a Possible Passing from the Digital to the Symbolic*, p. 2, https://www.hkw.de/media/texte/pdf/2017_2/2o3tiger/170530_2o3Tiger_PDFs_Yuk_Hui_press_new.pdf, accessed 28.05.2019.

100 T. Morton, op. cit., pp. 1–2.

space: we are unable to control the plastic waste, utilize it, and even fully predict its impact on the planet's fate (or more broadly on cosmos—taking into account the ideas of plastic utilization in space). Plastic clusters create at the same time speculative spaces, which are the objects of various speculative practices (like hyperobjects in general) and extremely real, as they transform the material structures of the biosphere. On the one hand, unlike e.g. radiation, plastic is fully visible and present, so it's hard to deny its existence.[101] On the other hand, its toxicity is not fully visible, as it manifests itself only in a wider temporal and spatial perspective. So, in a sense, plastic is a liminal hyperobject, constantly existing between the sphere of speculation and material, toxic belonging to physical reality. It is an object of post-climate reality, fully made by human, but at the same time going beyond its cognitive powers. Therefore the concept of the Plastisphere presented in the Yoldas project introduces very convincingly the potential, but also the limitations of Morton's theory.

With reference to the partial definition of fictionality proposed by Alber, namely that "the unnatural radicalizes the fictional through the representation of impossibilities that are nonactualizable",[102] one may consider whether "strongly possible worlds" are fictional, non-fictional, or forming an interesting example of time-space existing on the border of fiction and the real world. The last variant seems the most convincing as—on the one hand—these are logically and materially actual and possible time-spaces, and—on the other hand—often they are also creations that do not exist naturally (peculiar characters, physical parameters creating hermetic environments). One should add that it would be difficult to build this type of possible world in any other medium.

This kind of medium of artistic activities influences not only the universe design itself, but also factors determining the existence of the story. It is this reaction of the world, in connection with the specific physical matter, that motivates the recipient to observe changes and events resulting from those, caused by the desire of the actors/forces to achieve certain goals. The internal purpose of changes and the immanent self-agency of agents, characteristic of these universes, are crucial to their narrativity, as they go beyond the categorizing frames of description or statement. The narrativity of all the mentioned projects arises from the way the worlds are created and from the intentionality of the actors, which are possible in this form especially because of the specificity of a given medium. For this reason, also a storyworld created on this basis constitutes a borderline and hybrid structure: it exists on the border of what is ontologically possible, speculative and (un)natural, in fact establishing the performative universe of the story.[103]

[101] Com. ibid., p. 58.

[102] J. Alber, op. cit., p. 32.

[103] For information about the idea of "transmedia storytelling" see: e.g. H. Jenkins, "Transmedia Storytelling", *MIT Technology Review* 2003, January 15, https://www.technologyreview.com/s/401760/transmedia-storytelling/, accessed 20.10.2016.

The category of "strongly possible worlds" clashes also with the anthropocentric aspect of the concept of impossible worlds. To Alber, the impossibilities of literary universes are always created by human authors, and thus they should be considered from the human perspective.[104] Meanwhile, in non-verbal messages, "strongly" means the immanent inclusion of agential non-human actors in the construction of artistic universes—including them in the ontological dimension of the projects. As in the *agencial realism* conducted by Karen Barad, they are interweaved in intra-actions.[105] This is such a strong degree of penetration of the issue of what is real that, on the other hand, it also questions the mimetism of these projects -these are no longer only possible, but hyperpossible: not simulations or reconstructions, but physical, material creations, even if they are speculative visions; ones co-created by biological beings on the level of organic matter and metabolic processes. However, such "physical realism" should not be understand as *radical realism* criticized by Lewis, but in reference to the consideration of Aloi: "The materiality of objects in contemporary art, including taxidermy, should therefore not be understood as a site of truth of a higher kind but as a heightened register of realism that garners its semantic strength from the sociopolitical implications that have produced it".[106] What is more, biological art's universes are not contained within "impossible storytelling scenarios", just as "talking animals" in Alber's concept[107]—they are unnatural (on the border between natural and artificial) and possible at the same time. As non-human actors, they co-create both the storyworld and possible worlds in bio art projects—they are not mere creations making the narrative and the universe in which it develops strange.

Biological art as an alternative way of creating the world of a story?

One of Alber's most interesting insights in his theory of impossible worlds is the fact that the researcher notes that narration may change our perception of the naturality of space and the elements that condition it.[108] On the other hand, Ryan's observation—that in order to be stimulated, narrative processes and activities require the creation of a mental model of space for this narration in the recipient—shows an interesting connection in the relationship between narration and space.[109] The categories that address this connection in different ways, such as "narrative space", "story space", or

[104] J. Alber, op. cit., p. 17.
[105] K. Barad, op. cit., pp. 202–221.
[106] G. Aloi, op. cit., p. 11.
[107] J. Alber, op. cit., pp. 62–71.
[108] Ibid., pp. 186-187.
[109] M.-L. Ryan, "Cognitive Maps and the Construction of Narrative Space", in: *Narrative Theory and the Cognitive Sciences*, ed. by D. Herman, New York: Center for the Study of Language and Information, 2003, p. 237.

the discussed "storyworld" or "possible worlds", appear to be even more important and complex when narration is considered, as they involve its border areas. Within those, the most worthy of consideration—because usually overlooked (Alber also neglects to consider this type of narration)—are, I believe, non-verbal messages, shaped by the ontological status and the development of space, such as: gardens, architectural structures, open space activities, or numerous contemporary artistic directions, mainly within performative art (land art, relational art, etc.). Biological art is both a non-verbal message as well as a borderline case of narration, additionally—as I have tried to show in the article— testing the frameworks of fiction and non-fiction.

For the purpose of the analyzed examples of biological storyworlds and possible worlds, I have coined the category of "strongly possible worlds" because—although on the one hand these are examples of the creation of artistic universes—they force us to take into consideration a very important aspect of their material, physical constitution by means of the media specificity. This aspect, in case of verbal messages, may be analyzed only partially—in the context of the author's creative imagination and the recipient's cognitive processes. I related my proposed idea mainly to Jan Alber's concept of "impossible worlds", which indicates the subversive type of narrative universes, as "strongly possible worlds" also appear to implement the idea of the alternative way of creating the world for a story. This alternativeness arises from the fact that "strongly possible worlds" are not only conceptualized or described, but materially created. Very often, these are hermetic environments (such as the laboratory containers in which tissue dolls are stored) and leaving them means contact with a different time-space. Therefore, they are not only a separate part of reality, but its version based on specific parameters. These universes might generate a different type of storytelling that is not only transmedia but also based on scientific procedures and processes controlled by bioengineers, as if instead of the narrator causing subsequent changes within the universes, controlling events, defining character transformations.

Finally, although "strongly possible worlds" probably to a smaller extent than "impossible worlds" cause, to quote Zunshine, "cognitive uncertainty",[110] their ontological status remains much more defined that in case of literature or audiovisual works. Therefore, in a sense, they constitute an alternative to possible worlds described in literary theory, largely resisting the abovementioned objections of philosophers referring to the ontological uncertainty and instability of literary universes. For this reason, paradoxically, they challenge narratology, which is only beginning to realize the complexity and attractiveness of non-verbal forms of storyworlds and possible worlds.[111]

[110] L. Zunshine, op. cit., p. 164.

[111] Still, the most interesting and comprehensive publication on this matter appears to be the cited *Storyworlds across Media: Toward a Media-Conscious Narratology*, ed. by M.-L. Ryan and J. Noël Thon (2014).

Bibliography

Alber J., *Unnatural Narratives: Impossible Worlds in Fiction and Drama*, Lincoln–London: University of Nebraska Press, 2016.

Alexenberg L., *The Future of Art in a Postdigital Age: From Hellenistic to Hebraic Consciousness*, Bristol: Intellect Books, 2011.

Aloi G., *Speculative Taxidermy: Natural History, Animal Surfaces, and Art in the Anthropocene*, New York: Columbia University Press, 2018.

Ascott R., *Reframing Consciousness: Art, Mind and Technology*, Exeter–Portland: Intellect Ltd., 2001.

Barad K., *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*, Durham–London: Duke University Press, 2007.

Bogost I., *Alien Phenomenology, or What It's Like to Be a Thing*, Minneapolis: University of Minnesota Press, 2012.

Bryant L.R., *The Democracy of Objects*, Ann Arbor: Open Humanities Press, 2011.

Burii R.V., Dumit J. (eds.), *Biomedicine as Culture: Instrumental Practices, Technoscientific Knowledge, and New Modes of Life*, New York: Routledge, 2007.

Catts O., Zurr I., "Growing Semi-Living Sculptures: The Tissue Culture & Art Project", *Leonardo* 2002, vol. 35, no. 4.

Coole D., Frost S. (eds.), *New Materialism: Ontology, Agency, and Politics*, Durham: Duke University Press, 2010.

da Costa B., Kavita P. (eds.), *Tactical Biopolitics: Art, Activism, and Technoscience*, Cambridge–London: The MIT Press, 2008.

Dzidowski A., "New and Speculative Organisational Aesthetics", *Organisational Aesthetics* 2015, vol. 4, no. 1.

Ferrando F., *Philosophical Posthumanism*, London: Bloomsbury Publishing, 2019.

Fludernik M., *Towards a Natural Narratology*, London: Routledge, 1996.

Herman D., "Narratology beyond the Human", *Diegesis 3. Interdisziplinäres E-Journal für Erzählforschung* 2014, no. 2, https://www.diegesis.uni-wuppertal.de/index.php/diegesis/article/view/165/218, accessed 25.05.2019.

Howell R., "Fictional Objects: How They Are and How They Aren't", *Poetics* 1979, no. 8.

Hui Y., *On the Existence of Digital Objects*, Minneapolis: University of Minnesota Press, 2016.

Hui Y., *On a Possible Passing from the Digital to the Symbolic*, https://www.hkw.de/media/texte/pdf/2017_2/2o3tiger/170530_2o3Tiger_PDFs_Yuk_Hui_press_new.pdf, accessed 28.05.2019.

Ioannou C.C., Singh M., Couzin I.D., "Potential Leaders Trade Off Goal-Oriented and Social Behavior in Mobile Animal Groups", *The American Naturalist* 2015, no. 186 (2).

Jenkins H., "Transmedia Storytelling", *MIT Technology Review* 2003, January 15, https://www.technologyreview.com/s/401760/transmedia-storytelling/, accessed 20.10.2016.

Kekou E., "Interview with Anna Dumitriu", *4Humanities International Correspondent* 2013, January 18, http://4humanities.org/2013/01/dumitriu-interview/, accessed 26.05.2019.

Latour B., *Pandora's Hope: Essays on the Reality of Science Studies*, Cambridge–London: Harvard University Press, 1999.

Latour B., *Splatając na nowo to, co społeczne. Wprowadzenie do teorii aktora-sieci*, Kraków: Universitas, 2010.
Lewis D.K., *On the Plurality of Worlds*, Oxford: Blackwell, 1986.
Łebkowska A., "Fictional Worlds", Thomas G. Pavel, Cambridge, MA and London 1986 [review], *Pamiętnik Literacki* 1989, no. 3 (80).
Massumi B., *Parables for the Virtual: Movement, Affect, Sensation*, Durham: Duke University Press Books, 2002.
Mitchell R.E., *Bioart and the Vitality of Media (In Vivo)*, Seattle: University of Washington Press, 2010.
Morton T., *Hyperobjects: Philosophy and Ecology after the End of the World*, Minneapolis–London: University of Minnesota Press, 2013.
Reichle I., "Speculative Biology in the Practices of Bioart", *Artlink* 2014 (September), vol. 34, no. 3.
Rembowska-Płuciennik M., *Poetyka intersubiektywności. Kognitywistyczna teoria narracji a proza XX wieku*, Toruń: Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika, 2012.
Reschner N., *G.W. Leibniz's Monadology*, Pittsburgh: University of Pittsburgh, 1991.
Ronen R., *Possible Worlds in Literary Theory*, Cambridge: Cambridge University Press, 1994.
Ryan M.-L., "Cognitive Maps and the Construction of Narrative Space", in: *Narrative Theory and the Cognitive Sciences*, ed. by D. Herman, New York: Center for the Study of Language and Information, 2003.
Ryan M.-L., *Possible Worlds, Artificial Intelligence, and Narrative Theory*, Bloomington: Indiana University Press, 1992.
Ryan M.-L., "Possible-Worlds Theory", in: *Routledge Encyclopedia of Narrative Theory*, ed. by D. Herman, M. Jahn, M.-L. Ryan, London: Routledge, 2005.
Ryan M.-L., "Story/Worlds/Media: Tuning the Instruments of a Media-Conscious Narratology", in: *Storyworlds across Media: Toward a Media-Conscious Narratology*, ed. by M.-L. Ryan, J.-N. Thon, Lincoln–London: University of Nebraska Press, 2014.
Stromberg J., *An Artist Dyes Clothes and Quilts with Tuberculosis and Staph Bacteria*, http://www.smithsonianmag.com/arts-culture/artist-dyes-clothes-quilts-tuberculosis-and-staph-bacteria-180949511/?no-ist, accessed 22.05.2019.
Twardoch E., "Afektywne opowieści ciała. Narracje i potencjał narracyjny sztuki biologicznej", *Tekstualia. Palimpsesty literackie, artystyczne, naukowe. Narratologia transmedialna* 2015, no. 4 (43).
Wilkens T., *The Role of Narrative in Understanding Digital Video: An Exploratory Analysis*, https://open-video.org/papers/Wilkens_Asist_2003.pdf, accessed 26.05.2019.
Wolfe C., *Animal Rites: American Culture, the Discourse of Species and Posthumanist Theory*, Chicago: The University of Chicago Press, 2003.
Zunshine L., *Strange Concepts and the Stories They Make Possible*, Baltimore: Johns Hopkins University Press, 2008.

Artists' Websites

http://la-cura.it, accessed 22.05.2019.
http://www.lozano-hemmer.com, accessed 22.05.2019.

http://annadumitriu.tumblr.com/RomanticDisease, accessed 22.05.2019.
https://annadumitriu.tumblr.com/ArchaeaBot, accessed 24.05.2019.
https://pinaryoldas.info/Ecosystem-of-Excess-2014, accessed 20.05.2019.
https://aliciaking.net/artwork/912636-The-Vision-Splendid.html, accessed 20.05.2019.
http://www.symbiotica.uwa.edu.au/research/postgraduate/tarsh-bates, accessed 26.05.2019.
http://guybenary.com/work/in-potentia/, accessed 26.05.2019.
http://www.sonjabaeumel.at/work/bacteria/expanded-self, accessed 26.05.2019.
https://www.vaughnbell.net/one-big-house.html, accessed 26.05.2019.